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A Comprehensive Review on Pharmacological Properties of Garden cress (*Lepidium sativum*) Seeds

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ABSTRACT

The present article gives important information of *Lepidium sativum* on therapeutic use, traditional medicinal uses mention in various Ayurvedic literature, phytochemical and pharmacological properties of modern era. *Lepidium sativum*, garden cress is a fast growing annual herb that is native to Egypt and West Asia, although it is now cultivated in the entire world. *Lepidium sativum* seeds contain proteins, dietary fiber, omega-3 fatty acids, iron, other essential nutrients and phytochemicals. *Lepidium sativum* seeds are commonly used to heal fractures and to increase milk secretion during lactation. Their seeds are highly nutritious and are excellent source of iron. It mainly contains alkaloids, carbohydrates, proteins, amino acids, flavonoids as chief phytochemical constituents.

This review article shows various pharmacological activities of *Lepidium sativum* as an anti-diabetic, laxative, hypocholesterolemic, fracture healing, analgesic, Antinflammatory, antipyretic and analgesic, laxative, diuretic, hepatoprotective, antiasthmatic, antiarrhythmic, antispasmodic and anti cancer activities of garden cress seeds (*Lepidium sativum*).

Keywords: *Lepidium sativum*, Garden cress, pharmacological activities.

1. INTRODUCTION

Garden cress, *Lepidium sativum* is an annual, herbaceous edible plant that is botanically related to mustard and watercress. It is native to Egypt and South west Asia and cultivated in India¹, North America and parts of Europe². In some regions, it is known as garden pepper grass, pepper cress, pepperwort or poor man's pepper³.

Garden cress seed belongs to Brassicaceae family and its scientific name is *Lepidium sativum*. Common names of Garden cress (*Lepidium sativum*) seeds are Common Cress (English), *Halim* (Bengali), *Aseliyo* (Gujrati), *Chansur* (Hindi), *Allibija*, *Kapila* (Kannada), *Alian* (Kashmiri) *Asali* (Malayalam), *Ahaliva*, *Haliv* (Marathi), *Allivirai* (Tamil) and *Adityalu*, *Aadalu* (Telugu)⁴. The seeds are the major part of the crop, commonly used. They are small, brownish red in color, oval in shape, triangular and pointed at one end and smooth in texture⁵. Many studies conducted on garden cress (*Lepidium sativum*) seeds shows that it have a lot of pharmacological activities like anti anemic, anti-diabetic, aperients, diuretic, and tonic, also possess galactagogue and emmanagogue activities⁶.

Garden-cress (*Lepidium sativum*) seeds has been considered as a very useful medicinal plant and used as a medicine in Ayurvedic System of Medicine since the Vedic era. *Lepidium sativum* description is also available in the Ayurvedic classical text with the name as *Chandrasoora*, *Chandrika*, *Vasapushpa*, and the seeds, known as *hurf* or *halim* in local language in India⁷.

According to scientific analysis, seed have 80–85% endosperm, 12–17% seed coat and 2–3% embryo. Seed contain 25% protein, 14-24% lipids, 33-54% carbohydrates and 8% crude fiber⁸⁻⁹. It shows many type of pharmacological activities¹⁰. In traditional medicinal system, Garden cress seed (*Lepidium sativum*) have been widely used in treating number of diseases in India¹¹, Such as hypertension, diabetes, osteoarthritis diseases, in fracture healing¹² and in prevention of cancer. Essential fatty acids of seed used as memory boosters¹³. The galactogogue properties of *Lepidium sativum* seeds are well known and traditional preparations including *kheer* is prepared for lactating mother to increase milk production¹⁴⁻¹⁵.

2. MORPHOLOGY

Garden cress (*Lepidium sativum*) seeds are smooth, small and reddish brown in color. Shape is oval with point and triangular at one end. Seed length is about 3-4 mm and wideness is 1 -2 mm. When seed is soaked in water seed coat swells and gets covered with transparent, colorless, mucilage and give mucilaginous taste¹⁶⁻¹⁷.

Bioavailability is studied and compared.³⁻⁵ Sophisticated techniques like High performance liquid chromatography (HPLC), Gas chromatography(GC), Mass spectroscopy (MS) are being used to assess the plasma drug concentration of both types of drugs in order to find the pharmacokinetic parameters and bioequivalence data. FDA guidelines state that the generic drugs must be bioequivalent to its branded counterpart and only the generic version with proved bioequivalence and effectiveness are only given the approval to enter into the market⁵. Generic drugs are meticulously tested to make certain their presentation and ingredients meet the FDA's standards for equivalency.⁶

3. MICROSCOPIC CHARACTERS

The microscopic characteristics of Garden cress (*Lepidium sativum*) seeds shows endosperm of seed is composed of thick walled polygonal cells and embryo is covered by endosperm cells. The cells of embryo are polygonal in shape and minute in size. Seed powder is creamish yellow in colour, show uniform thick walls, few reddish-brown fragments of seed coats with oily endosperm and reddish coloring matter^{16,18}.

4. PHYSICO-CHEMICAL PROPERTIES OF SEED OIL

Physico-chemical properties of Garden cress (*Lepidium sativum*) seeds are highly essential for storage and stability of seed oil. Study carried out by Muhammad Zia-Ul-Haq et al¹⁹. reported the physicochemical composition of seed oil which is shown in Table 1.

5. CHEMICAL ANALYSIS

Analysis of cress seeds gave the following values: moisture 5.69, protein 23.5, fat, ash, phosphorous, calcium, sulphar. The seeds contain an alkaloid (0.19%), glucotropaeolin, sinapin (choline ester of sinaptic acid), sniaptic acid, mucilaginous matter and uric acid; on steam distillation they yield a volatile oil similar to that from the whole herb. Five new dimeric imidazole alkaloids lepidine B, C, D, E and F in addition to the known imidazole alkaloid lepidine and two new monomeric imidazole alkaloids semiledinoside A and B were isolated and structure elucidated on the basis of spectroscopic evidence²⁰.

Table 1: Physico-chemical parameters of Garden cress seed oil

Parameters	Observation/Value
Colour	Dirty Yellow
Refractive index	1.47 ± 0.08a
Specific gravity	0.82 ± 0.06a
Unsaponifiable matter	0.57 ± 0.02b
Acid Value	1.04 ± 0.05b
Saponification value	179.03 ± 0.73 b

Data are expressed as the mean ± standard deviation; values in the same row having different letters differ significantly (p<0.05).

The most main compounds found in extracted oil from garden cress seeds were Gamma-Tocopherol (36.11%), Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester (10.3%), Palmitic acid (5.44%), cis-13,16-Docosadienoic acid (5.08%), Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, methyl ester (4.88%), 1-Glycerol stearate (4.56%), (Z)-13-Docosenamide (3.01%), α -Cyanotoluene (2.93%), 11,14-Eicosadienoic acid, methyl ester (2.43%), Meadowlactone (1.68%), Hexadecanoic acid, methyl ester (1.57%) and Bis(2-ethylhexyl) phthalate (1.27%)²¹.

Isolation and fractionation of the glucosinolate contents of *Lepidium sativum* seeds revealed the isolation and identification of glucotropaeolin and 2-phenyl ethyl glucosinolate while the study of the glucosinolate contents of the fresh herb revealed the presence of 2-ethyl butyl glucosinolate, methyl glucosinolate, butyl glucosinolate and glucotropaeolin²².

6. PHARMACOLOGICAL PROPERTIES

6.1 Anti-diabetic property

The blood glucose levels were normalized in 2 weeks after daily repeated oral administration of aqueous *Lepidium sativum* extract (20mg/kg)($p < 0.001$). Blood glucose levels were significantly reduced in normal rats after both acute ($p < 0.01$) and chronic treatment ($p < 0.001$). No changes were observed in basal plasma insulin concentrations after treatment either in normal or STZ diabetic rats indicating that the underlying mechanism of this pharmacological activity seems to be independent of insulin secretion²³.

6.2 Fracture healing property

Garden cress (*Lepidium sativum*) seeds mixed with normal diet and fed to the rabbits after the surgery where as no seeds were given to the control group. X rays of induced fractures were taken at a regular interval postoperatively to assess the healing of the fractures. *Lepidium sativum* seeds had a marked influence on fracture healing in rabbits²⁴.

6.3 Hypercholesterolemic activity

Protective effect of *Lepidium sativum* L. seeds powder and extract was studied for its hypercholesterolemic effect on rats²⁵.

6.4 Antidiarrheal activity

A study carried out by manohar co-workers reported antidiarrheal effect of alcoholic and aqueous extract of *Lepidium sativum* seeds in three animal models (Castor oil induced diarrhea in rats, Prostaglandin induced enteropooling in rats and charcoal meal test in mice) of diarrhea;

Furthermore, the aqueous extract was found to be more potent than alcoholic extract²⁶.

6.5 Anti-oxidant activity

Ethanol extract of *Lepidium sativum* seeds showed a potential nephrocurative, nephroprotectivity and invivo antioxidant potential at 200mg/kg and 400mg/kg against Cisplatin(5mg/kg, i.p) induced nephrotoxicity. The enzyme estimation in Kidney tissue found that increased in malondialdehyde, superoxidedimutase, catalase and reduced glutathione level²⁷.

6.6 Prokinetic and laxative activities

The aqueous methanolic extract of *Lepidium sativum* L. seeds at 30 and 100mg/kg showed atropine sensitive prokinetic and laxative activities in mice which were partially sensitive to atropine. In isolated gut preparations of mouse and guinea pig at a dose of 0.1mg/ml caused concentration dependent stimulatory effects both in jejunum and ileum, which was blocked the presence of atropine²⁸.

6.7 In the treatment of Osteoarthritis

Lepidium seed powder was studied in 98 patients of osteoarthritis. In this study 30% patients got complete remission, 37.5% patients got marked improvement, 25% patients were moderately improved and 7.5% patients were not improved. The results was encouraging and supports the classical claim that seed of the plant *Lepidium sativum* is effective in alleviating the symptoms of *Sandhivata* and can be used extensively for the treatment of this disease²⁹.

6.8 Diuretic activity

The diuretic effect of aqueous and methanolic extracts of the Garden cress (*Lepidium sativum*) seeds in adult male Wistar rats Extracts were administered orally to experimental rats at doses of 50 and 100mg/kg body weight. Both the extracts of Garden cress (*Lepidium sativum*) seeds showed a dose-dependent increase in urine excretion. The excretion of sodium was increased by both the extracts and potassium excretion was increased only by the aqueous extract at a dose of 100 mg/kg. The methanolic extract had the additional advantage of a potassium-conserving effect. Aqueous and methanolic extracts of seeds showed notable diuretic effect which is comparable to that produced by the reference diuretic hydrochlorothiazide³⁰.

6.9 Effect on Sperm Parameters

In study conducted by NS Najji (2013) the effect of phenol extract of Garden cress (*Lepidium sativum*) seeds on sperm parameters of adult male rabbits. Their result shows that Medium Effect Dose (MED50) of phenols was obtained by

Dose-Response Curve. MED50 of Garden cress (*Lepidium sativum*) seeds seed phenols was 36.1 mg/kg body weight. There was a significant increase in testicular sperm concentration, epididymus sperm concentration and in the sperm count per gm of the testis, sperm motility percent, grade activity, sperm viability percent, and abnormal sperm morphology percent of epididymis caudal at MED50 of Garden cress (*Lepidium sativum*) seed phenol. Authors reported that supplementation with low doses of *Lepidium sativum* seed phenols could enhance rabbit fertility. Researcher concluded that phenol extract of *Lepidium sativum* seeds improves some parameters of sperm³¹.

6.10 Antinflammatory, antipyretic and analgesic activities

An ethanolic extract of Garden cress (*Lepidium sativum*) seeds extract significantly inhibited carrageenan-induced pedal oedema in rats. However, only a weak inhibition of cotton pellet-induced granuloma was observed in rats fed with extract. Garden cress (*Lepidium sativum*) seed extract administration significantly prolonged the hot plate reaction time shows its analgesic activity. The coagulation studies showed that the extract produced a significant increase in fibrinogen level and insignificant decrease in prothrombin time³².

6.11 For treatment of anemia

Garden cress (*Lepidium sativum*) seeds are the richest source of non heme iron [iron found in hemoglobin, which is an easily absorbed dietary iron.] It helps to increase the hemoglobin levels. It helps to alleviate anaemia when taken regularly. It is advisable to have vitamin C half an hour after consumption of these seeds as it enhances iron absorption³³.

6.12 Effect on respiratory function in bronchial asthma

A study conducted on 30 patients (male and female both) suffering from mild to moderate bronchial asthma whose age was 15 years to 80 years excluding pregnant women. One gram of finely ground seed powder was given orally to the patients for thrice a day for 4 weeks without providing medicine. Respiratory functions were assessed with Spirometer before and after the experimental period, and it was observed that there were significant improvements in different pulmonary functions. No any adverse effect was observed in any patients³⁴.

6.13 Antimicrobial Activity

Petroleum ether extract of seed in concentrations of 2.5%, 5% and 10% had active antimicrobial effect against six different pathogens together with powerful antifungal activity at the concentration of 2.5 and 10%³⁵. Ethanolic extract of seed was found very effective against fungal growth (*Fusarium equiseti*, *Aspergillus flavus* and *Alternaria alternat*) at 2-8% of seed extracts³⁶.

6.14 Cytotoxic effect on breast cancer

The Garden cress (*Lepidium sativum*) seed aqueous extract have a significant cytotoxic effect on MCF-7 cells by causing significant time and dose dependent decrease in their viability. In contrast the HFS cells were significantly more resistant to the cytotoxic effect of the extract and seed extract show ability to inhibit growth of breast cancer cell³⁷.

6.15 Nephrocurative and nephroprotective activity

Ethanolic extract of Garden cress (*Lepidium sativum*) seeds was used against cisplatin induced nephrotoxicity in adult male Wistar rats. The nephroprotective test group received Garden cress (*Lepidium sativum*) seed ethanolic extract for 1 st to 10th day and cisplatin was administered on 11 th day. Nephrocurative test group received single dose of cisplatin on day 1 st, and after 6th day Garden cress (*Lepidium sativum*) seed ethanolic extract was administered up to 16th day. A dose of cisplatin induced loss in body weight, increased urea and creatinine level in serum in model control group, it was a significantly recovered in test groups which indicates increased glomerular filtration rate. There was significant increase in glutathione level and decrease in lipid peroxidation in nephroprotective and curative test groups. The study suggests that ethanolic extract of Garden cress (*Lepidium sativum*) seeds may possess nephrocurative and nephroprotective activity³⁸.

6.16 Galactagogue Potential

Galactagogue properties of Garden cress (*Lepidium sativum*) seeds were studied on adult female virgin Norway rats. Each experimental rat was administered 1.6 mg seeds powder /gm body weight /day for fourteen days. Different parameters (gross assessment, histological examination, enzymatic histochemical study, and hormonal assay of follicle-stimulating hormone, luteinizing hormone, prolactin, estrogen and progesterone) were assessed to study the effect of Garden cress (*Lepidium sativum*) seeds on the mammary gland of young adult virgin rats. All the parameters significantly exhibited a strong mammatrophic and lactogenic effects of Garden cress (*Lepidium sativum*) seeds on the non-primed mammary gland of adult virgin rats. Authors concluded that Garden cress (*Lepidium sativum*) seeds are most probably a real galactagogue and might be useful in induction of lactation³⁹.

6.17 Hepatoprotective effect

Researcher examined hepatoprotective effect of Garden cress (*Lepidium sativum*) seed methanolic extract for the prevention of carbon tetrachloride (CCl₄) induced liver damage. Garden cress (*Lepidium sativum*) seed methanolic extract (200 and 400 mg/kg body weight) was administered to rats having induced liver injury. Serum activity of alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine

aminotransferase (ALT) and bilirubin concentration were increased significantly in the group of rats received only CCl₄. There was a significant reduction in these parameters in groups administered with Garden cress (*Lepidium sativum*) seed extract, the severe fatty changes in the livers of rats caused by CCl₄ were also decreased. The researcher results shows that the methanolic extract of Garden cress (*Lepidium sativum*) seeds seems to possess hepatoprotective activity in rats⁴⁰⁻⁴¹.

7. CONCLUSION

Lepidium sativum Linn was, however, already known to Indian physicians prior to the sixteenth century. Garden cress (*Lepidium sativum*) seeds are rich source of proteins, dietary fiber, minerals and essential amino acids. Garden cress seed was rich in iron content. Iron rich supplements were found suitable for improving iron status in body. It contain phenolic compounds which might be responsible for its strong antioxidant capacity. Toxicology studies of Garden cress (*Lepidium sativum*) seeds revealed that It can be considered as non-toxic and safe. Seeds shows many medicinal properties such as antidiabetic, hypocholesterolemic, antihypertensive, antidiarrheal, antispasmodic, Antinflammatory, antipyretic and analgesic activities and laxative activities. It also has hepatoprotective, fracture healing, diuretic, nephrocurative, nephroprctective, galactogogue and used in breast cancer.

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